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ARTICLE

Targeting Citizen Experience: A Meta-analysis on the Relationship Between E-government Resources and E-participation Intention

Lifang Peng[1], Suli Wang[1], Hui Jiang[2], Kaichao Wang[3], Gang Li[4] and Yubo Peng[5]

[1]Xiamen University, China; [2]Tongji University, China; [3]Shanghai International Studies University, China; [4]Qilu University of Technology, China and [5]Xi'an Jiaotong University, China
Corresponding author: Hui Jiang; Email: fidojianghui@hotmail.com

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Abstract
To advance the understanding of how e-government resources drive e-participation, the current research conducts a meta-analysis on the relationship above from the perspective of citizen experience. This meta-analysis synthesizes 517 effect sizes from 126 empirical studies to examine how e-government resources influence citizens' e-participation intention. The findings highlight several key variables that moderate this effect. Specifically: (1) From the perspective of the experience channel, e-government resources are more effective in facilitating citizen e-participation intention when delivered through social (vs. official) channels. (2) From the perspective of the experience affair, e-government resources exert a stronger impact on citizen e-participation intention when targeting specific (vs. general) public affairs and when focusing on regional (vs. national) government affairs. (3) From the perspective of the experience environment, the effect of e-government resources on e-participation intention is stronger in developing (vs. developed) countries. Based on these findings, this study offers implications for governments and researchers and suggests directions for future research.

摘要
为深化理解政府资源如何驱动公民电子参与, 本研究从公民体验视角出发, 对上述关系进行了元分析。研究综合了来自126项实证研究的517个效应量, 以检验政府资源对公民电子参与意愿的影响。研究结果揭示了若干关键调节变量: (1) 从体验渠道视角来看, 通过社交渠道 (vs. 官方渠道)提供的政府资源更能促进公民电子参与意愿; (2) 从体验事务视角来看, 政府资源在面向具体 (vs. 一般)公共事务以及区域级 (vs. 国家级)政府事务时, 对公民电子参与意愿的影响更强; (3) 从体验环境视角来看, 在发展中国家 (vs. 发达国家), 政府资源对公民电子参与意愿的影响更为显著。基于这些发现, 本研究为政府和学者提供了相关启示, 并提出了未来研究方向。

Keywords: citizen experience; e-government resources; e-participation intention; experience affairs; experience channel; experience enviornment; meta-analysis

关键词: 元分析; 公民体验; 政府资源; 电子参与意愿; 体验渠道; 体验事务; 体验环境

Introduction

Lee, as a resident, is empowered to use an e-petition system to submit proposals on preventing the spread of COVID-19. However, the system's complex operation leaves him confused and overwhelmed. Therefore, he decides not to make any statement regarding public affairs. This study proposes that if Lee receives supportive resources – such as apps (i.e., technological resources), tutorial videos (i.e., service resources), and laws and regulations (i.e., social norm resources) provided

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by the government – he may develop the intention to learn and complete online petitions. We refer to such government-provided resources that enable citizens to facilitate their e-participation as e-government resources, and we posit that, under certain conditions, these resources can promote citizens' e-participation intention.

However, e-government resources exert varying influences on e-participation intention, a finding confirmed by numerous reports and studies. For example, Singapore's government introduced a 'one-stop citizen service shop' to provide a seamless citizen experience, resulting in 96% satisfaction among its citizens, while 4% expressed dissatisfaction (2019 Digital Government Development Report). Similarly, the Chinese government is actively enhancing citizen experience by offering resources (e.g., consultation services) through social media to promote e-participation intention. Despite these efforts, user ratings remain below 3 out of 5, indicating that only a minority of citizens are satisfied. The main reason is the difficulty governments face in providing all citizens with satisfactory e-participation experiences (Noci, 2007). This phenomenon has also been observed in other contexts (e.g., Rodrigues, Sarabdeen, & Balasubramanian, 2016). For instance, while information and communication technology can enhance citizens' e-participation intention in government decision-making and public affairs (Li & Shang, 2020), e-technology has also been found to exert negative effects (Charbaji & Mikdashi, 2003). Nevertheless, no clear conclusion has yet been reached regarding the underlying causes of these mixed outcomes.

Despite the growing body of research on e-government resources and e-participation intention, no prior study has systematically synthesized these findings using a meta-analytic approach. Existing studies have primarily relied on empirical analyses (e.g., Chen & Huang, 2009; Reddick & Zheng, 2017), which provide valuable insights but lack a comprehensive statistical integration of diverse results. The absence of such synthesis limits our understanding of the generalizability and contextual variations in the relationship between e-government resources and e-participation intention. To address this gap, this study employs meta-analysis to quantitatively assess the overall impact of e-government resources on e-participation intention and to identify key moderators that explain the observed inconsistencies.

There are several reasons for employing meta-analysis: (1) It allows for a comprehensive synthesis of findings from multiple studies, offering a more exhaustive and nuanced understanding of the complex relationship between e-government resources and e-participation intention (Çoğaltay & Karadağ, 2015). (2) It enables researchers to quantitatively evaluate the overall impact of e-government resources on e-participation intention, while accounting for the varied results and influencing factors reported across studies. (3) It facilitates the identification of potential moderators that may explain the mixed findings in the literature, thereby clarifying the mechanisms through which e-government resources influence e-participation intention.

Initially, we identify four crucial contingency factors from the perspective of citizen experience – channel (social vs. official), affair (specific vs. general; regional vs. national), environment (collectivist vs. individualist cultures; developing vs. developed countries; unitary vs. federal governance system), and actor characteristics (ordinary vs. professional citizens) – that influence e-participation intention. These factors, individually or in combination, influence e-participation intention in diverse ways. Through a meta-analysis of 517 correlations from 126 publications, we demonstrate that e-government resources are more effective in promoting e-participation intention when delivered through social (vs. official) channels, applied to specific (vs. general) government affairs, implemented at the regional (vs. national) level, and situated in developing (vs. developed) countries.

Notably, we position contextual variables as moderators that influence the strength of the relationship between e-government resources and e-participation intention. This theoretical framing enhances our understanding of context-specific effects in digital governance and highlights the need for more systematically developed frameworks in this domain.

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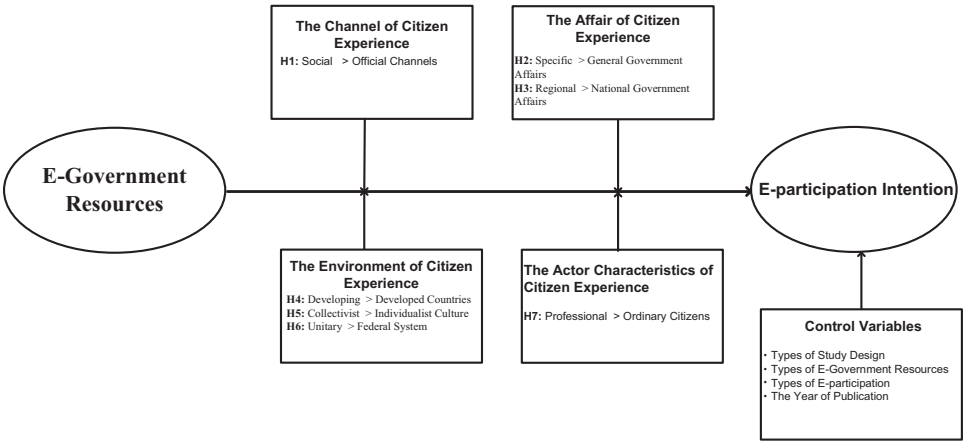


Figure 1. Influencing factors framework of the current meta-analysis
Note: > represents that the item in the left side has a stronger influence than that in the right side.

Theoretical Background

This section focuses on the concepts of e-government resources, e-participation intention, and citizen experience. Figure 1 presents an overview of our conceptual framework, illustrating how various factors shape the impact of e-government resources on e-participation intention.

The Concept of E-Government Resources

Based on resource-based theory, the resources possessed by an organization determine its performance and provide a competitive advantage (Barney, 1991). This theory extends beyond business to the field of digital governance, where governments enhance e-government performance by providing and optimizing essential resources, thereby promoting citizen e-participation (e.g., Ashaye & Irani, 2019; Vicente & Novo, 2014).

Research has shown that government-provided resources play a central role in facilitating citizen e-participation (Zheng & Ma, 2022). These resources serve as key external supports that shape citizens' intentions and abilities to engage in e-participation. Specifically, they include technological infrastructure (e.g., government websites and digital platforms) (Ferreira & Coelho, 2022), capacity-building programs (e.g., digital literacy training) (Aichholzer & Rose, 2020), and user-friendly online platforms designed to enhance accessibility and engagement (Ganapati, 2011).

Therefore, we define the supportive resources provided by governments to facilitate citizen e-participation as e-government resources. These resources include technological, educational, and platform-related components and so on, aiming to reduce participation barriers, increase accessibility, and promote effective digital governance.

In this meta-analysis, we operationalize e-government resources as a single, aggregated independent variable capturing the overall extent of digital resource provision by governments. While prior studies have identified technological, service, and social norm supports as distinct categories, we treat these as control variables in our analysis. This modeling choice allows us to focus on the overarching impact of government-provided digital support while statistically accounting for the influence of different resource types.

To implement this, we systematically review the independent variables from primary studies, retaining only those that directly reflect government digital efforts aimed at facilitating e-participation. Constructs such as political trust or demographic attributes were excluded unless they represented explicit government resource provision.

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Table 1. The details of e-participation development

Research stage	Theoretical foundation	Core indicators/concepts	Representative literature
Early Research	Technology Acceptance Model (TAM)	Technological determinants: Perceived Usefulness, Perceived Ease of Use, Facilitating Conditions	Davis & Davis, 1989
Later Research	DeLone & McLean Information Systems Success Mo Unified Theory of Acceptance and Use of Technology (UTAUT), Information System Adoption Model	System Quality, Information Quality, Service Quality, User Satisfaction, Continuance Intention	Delone & Mclean, 2003; Wang & Liao, 2008; Venkatesh, Morris, Davis, & Davis, 2003
Recent	Public Value Perspective	E-participation as a collaborative process: co-creating social value, enhancing transparency, strengthening trust between government and citizens	Twizeyimana & Andersson, 2019; Simonofski, Snoeck, Vanderose, & Clarinval, 2017

The Concept of E-Participation Intention

E-participation refers to the use of information technology to facilitate citizens' engagement in government affairs (e.g., Vicente & Novo, 2014). It serves as a fundamental tool for achieving participatory, inclusive, collaborative, and consultative public governance. E-participation intention plays a crucial role in its implementation, consistent with the theory of planned behavior (TPB), which identifies individuals' intentions as a key determinant of their behavior (Conner & Armitage, 1998). Therefore, in this study, e-participation intention is selected as the dependent variable.

Moreover, building on the concept of citizen e-participation, this study defines e-participation intention as citizens' willingness to use information and communication technologies (ICT) to engage in government policy, decision-making, service design, and service delivery.

The Content of Citizen Experience

Over the past 20 years, the e-participation literature has evolved through several distinct theoretical perspectives. More details are shown in Table 1.

While these perspectives have enriched the field, they also exhibit important limitations. Technology adoption models primarily explain initial acceptance, the IS success framework emphasizes system-level evaluations, and the public value approach focuses on collective outcomes. However, these perspectives often treat citizens either as rational adopters or passive recipients of services, overlooking the ongoing, multidimensional, and experiential nature of citizens' engagement with e-participation platforms.

To address this gap, this study adopts the citizen experience perspective. Consistent with Moore's (1997) argument that the quality of interactions between governments and citizens determines public value, e-participation is viewed not only as a functional process but also as an experiential one, in which citizens – similar to customers in service settings – form both cognitive judgments and emotional responses (e.g., Rincon-Novoa, Rojas-Berrio, & Robayo-Pinzon, 2022). Drawing on customer experience research (De Keyser, Verleye, Lemon, Keiningham, & Klaus, 2020), citizen experience can be understood as citizens' immediate reactions to government interactions, shaped by perceptions of relevance, transparency, trustworthiness, and empowerment.

Prior studies on user (e.g., citizen) experience highlight four broad categories (e.g., Brakus, Schmitt, & Zarantonello, 2009; Lemon & Verhoef, 2016): experience channel (Hoffman & Novak, 1996), affair (Schmitt, 1999), environment (Bitner, 1990), and user characteristics (Jain, Aagja, &

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Bagdare, 2017). Building on these studies, this research categorizes citizen experience into four dimensions: (1) the channel of citizen experience, which includes the experience channel; (2) the affair of citizen experience, comprising the experience field and experience level; (3) the environment of citizen experience, encompassing experience stage, experience culture, and experience system; and (4) the actor characteristics of citizen experience, referring to experiencer characteristics.

This framework provides a conceptual foundation for our empirical research, emphasizing the need for a detailed analysis that accounts for both contextual and individual factors to inform policy-making and citizen e-participation strategies.

Hypotheses Development

The Channel of Citizen Experience

Experience channel: Social vs. official channels

Social channels provide a more interactive and informal platform for participation, enhancing accessibility and reaching a broader audience (e.g., Lee & Kwak, 2012; Mergel, 2013). Unlike official government communication channels, social media platforms and online community forums enable direct, real-time interaction between citizens and government entities. This immediacy fosters inclusivity and transparency within the e-participation process, creating a more engaging and responsive civic environment (e.g., Arshad & Khurram, 2020; Dalakiouridou, Smith, Tambouris, & Tarabanis, 2012). In contrast, official channels, such as government websites and administrative systems, are often perceived as formal and unidirectional, potentially limiting opportunities for meaningful two-way communication and engagement (e.g., Lee-Geiller & Lee, 2019).

Furthermore, social channels facilitate peer-to-peer interaction and networking among citizens, enabling the exchange of ideas, experiences, and feedback (Nam, 2012). E-government resources delivered through these channels can leverage social influence and collective participation, as citizens are more likely to be influenced by their peers and social networks when considering e-participation (Schmitz & Fulk, 1991). By fostering a sense of community and belonging, social channels encourage more active citizen engagement. In contrast, official government channels may not fully utilize the potential of peer influence and often lack the communal dynamics inherent in social platforms. Therefore, we propose that:

Hypothesis 1 (H1): E-government resources through social channels have a greater effect on e-participation intention than those through official channels.

The Affair of Citizen Experience

Experience field: Specific vs. general government affairs

The experience field is divided into two dimensions – specific and general government affairs – based on the informational distance between citizens and public affairs. Specific government affairs typically address topics directly relevant to particular groups of citizens, such as healthcare (Varda, Shoup, & Miller, 2012), education (Kettl, 2001), and e-taxation (Chen & Huang, 2009). These issues carry significant personal relevance, fostering a stronger sense of urgency and emotional connection among affected citizens. When governments prioritize resources for such issues, citizens are more likely to perceive that their concerns are acknowledged and addressed, which can lead to greater engagement in e-government initiatives (Chan & Pan, 2008). Moreover, specific government affairs tend to attract higher levels of public attention, media coverage, and public discussion, stimulating increased interest and participation. Public engagement is further reinforced when individuals perceive that their participation has a direct impact on specific policies or decisions (Stern & Dietz, 2008). This heightened visibility and perceived efficacy can significantly encourage active e-participation.

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In contrast, general government affairs often involve broader, bureaucratic, or administrative topics, such as project proposals (Naranjo-Zolotov, Oliveira, & Casteleyn, 2018). While essential for governmental operations, these topics may seem distant and abstract to many citizens, as they often lack the immediate personal relevance characteristic of specific government affairs. Consequently, citizens may feel less motivated to engage in e-government initiatives related to general affairs, perceiving that their participation is unlikely to produce tangible outcomes (Moon & Norris, 2005). Thus, we propose that:

Hypothesis 2 (H2): E-government resources for specific government affairs have a greater effect on e-participation intention than those for general government affairs.

Experience level: Regional vs. national government affairs

This dimension distinguishes between regional and national government affairs based on the geographic scope of citizen participation in e-government initiatives. Regional government affairs include, for example, electronic tax-filing systems in Taiwan Province, China (Wang, 2003) and urban government initiatives in China (Zheng & Ma, 2022). In contrast, national government affairs encompass e-government implementation in Zambia (Bwalya, Du Plessis, & Rensleigh, 2012) and e-government services in the Netherlands (Horst, Kuttschreuter, & Gutteling, 2007). Research suggests that a narrower information distance can benefit users by enabling more effective information processing (Zhao & Xie, 2011). When the information distance between services and citizens is reduced, individuals can access more valuable information independently, which enhances their motivation to engage (Sikora & Chauhan, 2012).

Accordingly, this study assumes that citizens are more likely to access useful information independently in regional affairs, where the information distance is small, leading to higher e-participation intention. In contrast, a larger information distance between national authorities and citizens may reduce their intention to engage in public affairs. Thus, we propose that:

Hypothesis 3 (H3): E-government resources for regional government affairs have a greater effect on e-participation than those for national government affairs.

The Environment of Citizen Experience

Experience stage: Developed vs. developing countries

Developed countries typically possess advanced technological infrastructures, including widespread high-speed Internet access, stable electricity, and mature digital platforms. Citizens in these countries often already have the necessary tools and skills – such as smartphones, computers, and digital literacy – to engage in e-participation independently (e.g., Basu, 2004). Consequently, the marginal effect of additional government-provided e-resources may be limited.

In contrast, developing countries often face challenges such as unstable infrastructure, high access costs, and limited digital reach (e.g., Shahab, Bagheri, & Potts, 2021). In these contexts, government provision of digital platforms, training, and accessible services plays a crucial role in enabling citizen engagement. Therefore, the effect of e-government resources on e-participation intention is expected to be more pronounced in developing countries.

Therefore, we propose that:

Hypothesis 4 (H4): E-government resources in developing countries have a greater effect on e-participation intention than those in developed countries.

Experience culture: Collectivist vs. individualist cultures

In collectivist cultures, there is a strong emphasis on community, cooperation, and group harmony (Triandis, Bontempo, Villareal, Asai, & Lucca, 1988). E-government resources for e-participation

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that align with these cultural values can have a greater impact on motivating individual participation. When governments actively promote digital platforms for collective decision-making or community-driven initiatives, this resonates with cultural preferences for cooperation and mutual support (Zhang, Yu, & Tian, 2023). Citizens in collectivist cultures who perceive e-participation as contributing to community well-being or fulfilling social expectations may feel a stronger obligation to engage (Alathur, Ilavarasan, & Gupta, 2016).

In contrast, individualist cultures place greater emphasis on personal autonomy and independence (Chirkov, Ryan, Kim, & Kaplan, 2003). If e-government resources excessively intervene in citizens' personal affairs or decision-making, thereby limiting their autonomy, they may resist or reject such initiatives. Moreover, personal interests are a primary driver of behavior in individualist cultures (Sinha & Sinha, 2014). Citizens who perceive that e-government resources do not substantially serve their interests may be less likely to engage. Thus, we propose that:

Hypothesis 5 (H5): E-government resources in collectivist cultures have a greater effect on e-participation intention than those in individualist cultures.

Experience system: Unitary vs. federal systems

In a unitary system (e.g., China, the Republic of Korea, and Singapore), where political power is centralized (Toonen, 1990), e-government resources for e-participation can be deployed more effectively. Centralized governance enables efficient resource allocation, uniform technological infrastructure, and standardized digital participation platforms (e.g., Gerring & Thacker, 2004). With a single governing authority controlling public resources, e-government initiatives benefit from greater coordination and scalability, ensuring that citizens across regions have equal access to digital participation opportunities. Consequently, in unitary systems, government resources are more likely to result in higher levels of e-participation.

Conversely, in a federal system (e.g., the US, Malaysia, Nigeria, and Uganda), political power and government resources are decentralized, with responsibilities for resource allocation and digital governance distributed across multiple levels of government (Agranoff, 2014b). While government resources for e-participation are still provided, their effectiveness is influenced by the structural complexity of a multi-tiered governance system. Regional or local governments may have varying financial, technical, and administrative capacities, resulting in fragmented and inconsistent implementation of e-participation initiatives (Toonen, 1990). This variability in resource distribution can create disparities in e-government accessibility and quality, weakening the overall impact of government resources on citizen engagement (Agranoff, 2014a). Therefore, we propose that:

Hypothesis 6 (H6): E-government resources in unitary systems have a greater effect on e-participation intention than those in federal systems.

The Actor Characteristics of Citizen Experience

Experiencer characteristics: Professional vs. ordinary citizens

This study distinguishes between professional citizens (e.g., government employees) and ordinary citizens (e.g., students and general citizens) based on their level of professional e-government knowledge. This distinction is important because it reflects the varying levels of knowledge and understanding individuals possess when interacting with e-governance platforms. Citizens with professional expertise are more likely to actively engage in public affairs, as they have the necessary information to provide informed opinions and contribute meaningfully to discussions on public issues (Bratton, 1999).

Moreover, the study highlights the significant influence of perceived benefits on e-participation (Khasawneh, Hujran, & Abdrabbo, 2018). Individuals with higher professional knowledge tend to experience greater personal advantages from e-participation, such as improved job performance,

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enhanced productivity, and an increased sense of value. This suggests that perceived benefits play a crucial role in shaping engagement levels, particularly among those with professional expertise.

Building on these findings, the study suggests that professional citizens, owing to their deeper understanding and proficiency in e-governance, are likely to derive greater personal benefits from e-participation. These benefits serve as key motivators for active engagement in public affairs through digital platforms. Conversely, ordinary citizens, with limited professional knowledge, may perceive fewer personal advantages from e-participation, potentially leading to lower levels of engagement in e-governance initiatives.

The proposed framework suggests that differences in professional knowledge and the associated perceived benefits significantly influence citizen e-participation patterns, explaining the varying levels of engagement between professional and ordinary citizens in the context of e-governance. Therefore, we propose that:

Hypothesis 7 (H7): E-government resources for professional citizens have a greater effect on e-participation than those for ordinary citizens.

Control Variables

In addition to the main variables, several control variables were included to minimize potential bias. First, study design (e.g., questionnaire, database, or crawler) was controlled for, as different methodological approaches may affect the reliability and comparability of reported findings (Cleary, 1997). Second, the year of publication was considered to account for possible temporal effects, since the strength of the relationship between e-government resources and e-participation intention may change over time. Therefore, the year of publication was included as a control variable. Finally, the types of e-government resources (i.e., technology, social norm, and service) and the types of e-participation (i.e., monitoring, agenda-setting, and decision-making) were included as control variables, as variations in resource and participation types can influence perceived effort and trust, thereby shaping e-participation intention (e.g., Lai & Beh, 2025).

By incorporating these control variables, the analysis can more accurately isolate the substantive effect of e-government resources on e-participation intention, reducing the likelihood that the results are influenced by methodological or measurement artifacts.

Methods

The data used in this study have been deposited in the Open Science Framework (OSF) and are publicly available at https://osf.io/9yu7z/?view_only=713587f95ccd48a8a8071dceaaee0a5b

Selection Criteria

First, this study identified relevant literature using Web of Science, ScienceDirect, the ACM Digital Library, and Google Scholar. Search terms included 'Electronic government', 'e-government', 'e-gov', 'egov', 'participation', 'e-participation', 'intention', and combinations of these terms with 'e-voting', 'e-petition', 'e-democracy', 'e-empowering', 'e-information', 'e-consulting', 'e-involving', and 'e-collaborating'. Additionally, manual searches were conducted for abstracts published in Transforming Government: People, Process, and Policy (TGPPP), Electronic Government, International Journal (EGIJ), Government Information Quarterly (GIQ), and International Journal of Electronic Government Research (IJEGR), supplementing the electronic searches. Papers from journals focusing on information systems, management, and organizational behavior, as well as conference proceedings, were also examined. References were cross-checked to ensure completeness. To reduce sample bias, working papers from SSRN were accessed, and authors were contacted directly via email to obtain unpublished papers. The literature review covers the period 2000–2025.

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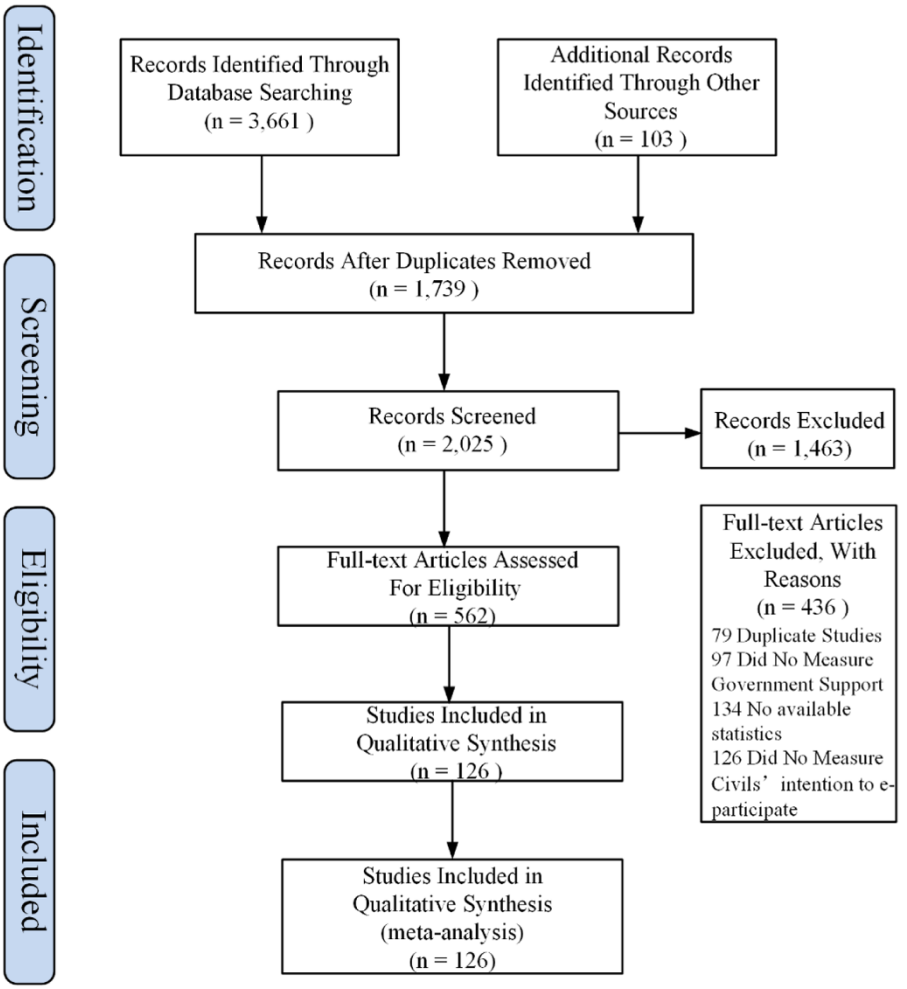


Figure 2. Flow diagram of studies selected for inclusion in the review

A total of 3,764 publications were initially identified as relevant to e-participation intention. After removing 1,739 duplicates, the titles and abstracts of the remaining 2,025 articles were screened for eligibility. Of these, 562 articles were considered potentially eligible and underwent full-text review, all of which were empirical studies. Ultimately, 126 publications met all inclusion criteria, which required measures of e-government resources, available statistical data, and e-participation intention. Following Moher et al. (2015), a flow diagram illustrating the search strategy and final selection process is presented in Figure 2.

Variable Coding

Referencing the coding process by Chang and Taylor (2016), after establishing definitions and coding standards for variables, both authors independently coded all studies. Table A1 in the Appendix outlines the basic coding criteria for key variables. The Kappa coefficient was calculated to assess the reliability between the two authors (Cohen, 1960). Initially, the independent coding by the two authors showed over 98% intercoder reliability for each component, indicating high reliability among raters (see Table A1 in the Appendix).[1] Any discrepancies in coding were resolved through discussion. The coding reliability was further assessed for moderators across all studies by a separate coder not

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involved in the study but knowledgeable about the topic. The reliability rate between the codes of the two authors and the independent coder exceeded 99% for each moderator, demonstrating a high reliability rate in the coding process. Any minor disagreements were resolved through discussion.

In total, 517 correlations between e-government resources and e-participation intention were coded from 126 papers (some details can be seen in Table A2 of Appendix).

Measures

E-government resources

Following meta-analytic practices established in prior studies (e.g., Liu, Guo & Chi, 2015; Zhang & Chen, 2023), which applied structured coding and effect size extraction in different research contexts, we systematically classified and coded e-government resources and extracted effect sizes for each study. We examined several types of e-government resources, including (1) technological resources, such as online service platforms and collaboration tools; (2) service resources, such as citizen service channels; and (3) social-norm resources, such as guidance documents and institutional support policies. We identified the measures of relevant studies, and if a study used one or more resources above, we considered these resources as e-government, and recorded their correlations with the outcome variable we examined in our study. For instance, correlations between individual resources and the same outcome variable were retained separately rather than averaged, in order to maximize the amount of data available for analysis (Hunter & Schmidt, 2004). This approach ensures methodological transparency and comparability across studies while providing more robust estimates of the relationships between resources and the outcome.

E-participation intention

This is measured by survey-based indicators capturing citizens' willingness to engage in e-government, such as behavioral intention, continuance usage intention, intention to use portals or mobile applications, and intention to participate in specific platforms.

Publication Bias

This study employed (a) a funnel plot, (b) fail-safe N, and (c) Egger's regression test to assess potential publication bias. As shown in Figure 3, most studies cluster near the top of the funnel plot and around the average effect size, with no studies appearing at the bottom, indicating minimal likelihood of publication bias. Additionally, the fail-safe N statistic proposed by Rosenthal (1979) was calculated to estimate the robustness of the results, as presented in Table 2. For example, the fail-safe N for e-participation intention is 68,074, suggesting that 68,074 unpublished studies would be required to nullify the significant results observed. Thus, the findings appear largely unaffected by publication bias.

Egger's regression test further supports this conclusion (intercept = 3.79, 95% CI = [0.24, 7.33], $p = 0.04$), indicating a low presence of bias. To evaluate the stability of the combined results, the trim-and-fill method was applied using the 'trimfill' function in the Comprehensive Meta-Analysis software. A random-effects model was used, with adjustment to the left, resulting in 28 hypothetical studies being added. The effect estimate was 0.31 (95% CI = [0.26, 0.36], $p < 0.001$) before trim-and-fill and 0.21 (95% CI = [0.16, 0.26], $p < 0.001$) after trim-and-fill. Although the adjustment affected the effect size, it did not alter the overall findings, indicating that publication bias does not significantly distort the results.

Model Construction

To examine potential moderating effects, hierarchical linear modeling was employed, accounting for within-study error correlations between effect sizes. Fisher z-transformed correlations were regressed on the hypothesized moderating variables as well as study-specific moderators. The specific Model 6

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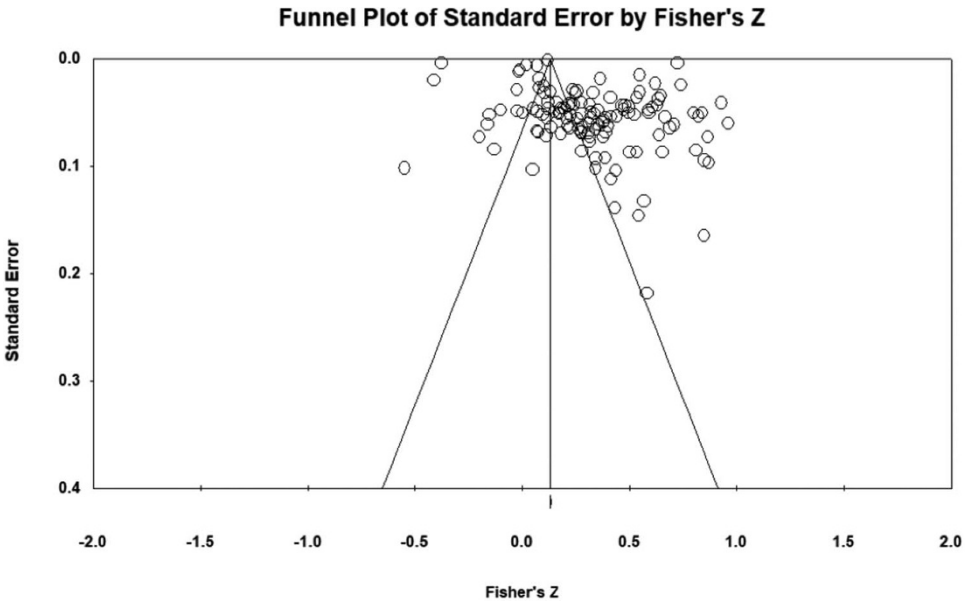


Figure 3. The distribution of effect value

Table 2. Overview of the e-participation intention relationships

Relationship	Sample size	N[d]	N[e]	Mean correlation		95% CI		I^2	Fail-safe N[c]
				Random[a]	Fixed[b]	Random[a]	Fixed[b]		
E-participation intention	126	517	871, 544	0.31**	0.13**	[0.26, 0.36]	[0.127, 0.132]	99.72	68, 074

Notes: $p < 0.05$, ** $p < 0.01$. [a]Random model point estimates. [b]We used the trim-and-fill method to calculate modified estimates of fixed effects for possible publication bias, as presented in Table 2 (Duval & Tweedie, 2000). [c]The number of non-significant, unpublished (or omitted) studies to be added to the meta-analysis that are required to transform the total observation from statistically non-significant to significant. [d]Number of Effects. [e]Number of Observations.

is estimated as follows:

$$Y_{ij} = \alpha_0 + \beta_1 x_{1i} + \ldots + \sum_{k=1}^{7} \alpha_k X_{kij} + u_j + e_{ij} \quad (1)$$

where Y_{ij} represents the Fisher z-transformed correlation coefficient observed in the j study. The term α_0 denotes the intercept, while α_k corresponds to the estimated coefficients of the moderator variables $X_{kij.}$ The term u_j captures the residual variance at the study level, accounting for between-study heterogeneity, and e_{ij} represents the residual error at the measurement level, reflecting within-study variability.

Analyses and Results

Data Analysis

Meta-analysis

A preliminary analysis examined the central tendency and distribution of effect sizes (Troy, Hirunyawipada, & Paswan, 2008). The 517 correlations between e-government resources and e-participation intention ranged from – 0.60 to 0.89, as shown in Figure 4. Among these, 4 correlations were 0, and 61 were negative (M = 0.27, SD = 0.25). The distribution deviated significantly from

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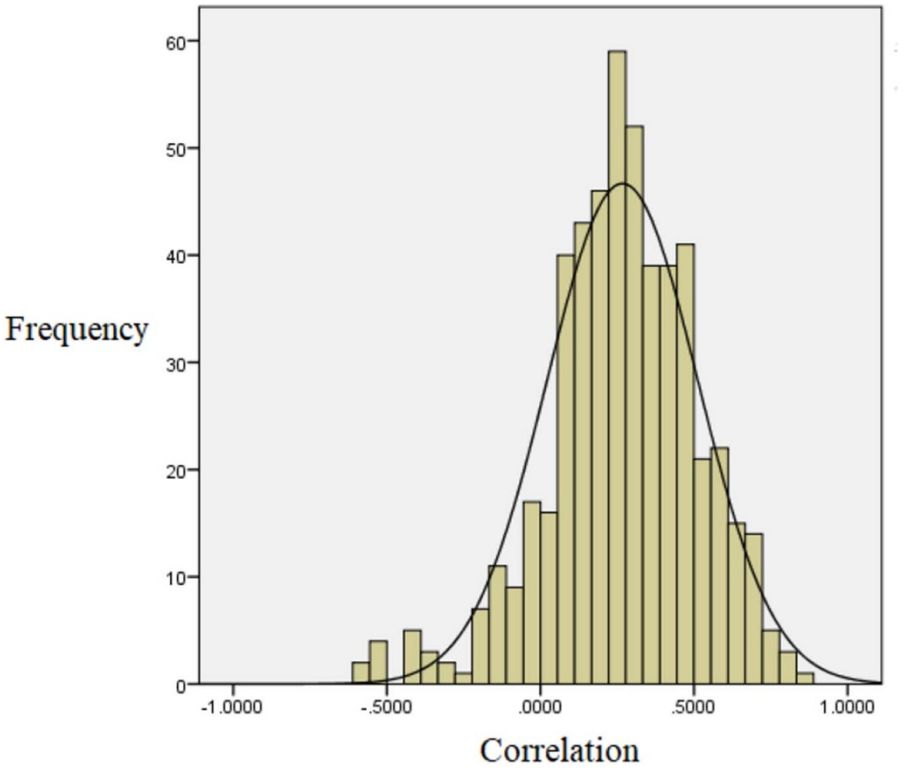


Figure 4. Frequency distribution of correlations

normality, exhibiting mild negative skewness (Z_skewness = – 0.54, $p < 0.01$) and slight leptokurtosis (Z_kurtosis = 0.87, $p < 0.01$).

Multicollinearity review

Before estimating the model, we assessed the possibility of multicollinearity among the variables. The results, presented in Table 3, indicate no serious collinearity between variables. For all eleven variables, variance inflation factors (VIFs) calculated from regressions using Z-transformed correlations ranged from 1.06 to 1.36, well below the commonly accepted threshold of 5, providing no evidence of multicollinearity.

Correlation Analysis

First, we calculated the mean correlation between e-government resources and e-participation intention. Measurement errors in each study were adjusted by dividing the correlation coefficients by the square roots of the variable reliabilities (Therese & Pigott, 2006). The adjusted correlation coefficients were then converted into Fisher's z-coefficients. To give greater weight to more precise estimates from larger samples, each coefficient was weighted by the inverse of its variance (Hayley, 2009). Finally, the weighted Fisher's z-coefficients were converted back to correlations. Table 2 presents the average correlations between e-government resources and e-participation intention.

Moderating Analysis

Results of main moderators

Substantial heterogeneity was observed (Q = 44,759.44, $p < 0.01$; $I^2 = 99.72\%$; see Table 2), supporting the need for moderator analyses (Hayley, 2009). Meta-regression was applied to examine

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Table 3. Pearson correlation matrix for the moderators

	1	2	3	4	5	6	7	8	9	10	11
1. Experience Channel: Social (vs. Official) Channels	1.00										
2. Experience Field: Specific (vs. General) Government Affairs	−0.13**	1.00									
3. Experience Level: Regional (vs. National) Government Affairs	−0.04	0.12**	1.00								
4. Experience Stage: Developed (vs. Developing) Countries	−0.13**	−0.08	−0.02	1.00							
5. Experience Culture: Collectivist (vs. Individualist) Cultures	0.07	−0.03	0.06	0.39***	1.00						
6. Experience System: Unitary (vs. Federal) System of Government	0.11*	−0.04	−0.17***	0.26***	0.31***	1.00					
7. Experiencer Characteristics: Professional (vs. Ordinary) Citizens	0.15***	−0.09*	−0.09*	0.06	−0.01	−0.03	1.00				
8. Type of E-government Resources: Technology vs. Service vs. Social Norm	−0.20***	0.01	0.05	0.27***	0.05	0.11*	0.04	1.00			
9. Type of E-participation: Monitoring vs. Agenda Setting vs. Decision-making	0.01	0.11*	−0.07	−0.22***	−0.07	−0.08	−0.13**	−0.11*	1.00		
10. Types of Study Design: Subjective (vs. Objective) Data	−0.13**	0.24***	0.12**	0.14**	−0.05	−0.04	−0.20***	0.13**	0.25***	1.00	
11. Year of Publication	0.07	0.02	−0.14**	−0.21***	−0.35***	−0.05	−0.004	−0.11*	0.012	−0.13**	1.00

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4. Moderating effect on the relationship between e-government resources and e-participation intention

	E-government resources
	Coefficient (SE)
Constant	0.83 (6.02)
Moderator Variable	
Experience Channel: Social (vs. Official) Channels	0.06 (0.04)*
Experience Field: Specific (vs. General) Government Affairs	0.08 (0.04)**
Experience Level: Regional (vs. National) Government Affairs	0.09 (0.04)**
Experience Stage: Developed (vs. Developing) Countries	0.11 (0.05)**
Experience Culture: Collectivist (vs. Individualist) Cultures	0.09 (0.06)
Experience System: Unitary (vs. Federal) System	0.06 (0.04)
Experiencer Characteristics: Professional (vs. Ordinary) Citizens	0.02 (0.04)
Control Variable	
Type of E-government Resources: Social Norm vs. Technology	−0.002 (0.04)
Type of E-government Resources: Service vs. Technology	−0.03 (0.03)
Type of E-participation: Agenda Setting vs. Monitoring	−0.05 (0.05)
Type of E-participation: Decision-making vs. Monitoring	−0.06 (0.04)
Type of Study Design: Objective (vs. Subjective) Data	0.04 (0.08)
Year of Publication	0.0002 (0.003)
Number of Effects	517
Number of Samples	126

Notes: * $p < 0.10$, ** $p < 0.05$, $p < 0.01$. We employed a random model to analyze the moderating effect.

the moderating effects (see Table 4). Specifically, as hypothesized in H1, e-government resources exert a slightly greater influence on e-participation intention through social channels than through official channels ($\beta = 0.06$, $p = 0.08$). Resources targeting specific government affairs have a stronger effect on e-participation intention than those targeting general affairs ($\beta = 0.08$, $p = 0.03$), supporting H2.

The influence of e-government resources on e-participation intention for regional government affairs is greater than for national affairs ($\beta = 0.09$, $p = 0.01$), supporting H3. Additionally, the effect is significantly stronger in developing countries than in developed countries ($\beta = 0.11$, $p = 0.01$), supporting H4. However, the impact of e-government resources on e-participation intention in collectivist cultures is greater than in individualist cultures ($\beta = 0.09$, $p = 0.11$), indicating that H5 is not supported. Similarly, H6, which posited a stronger effect in unitary versus federal systems ($\beta = 0.06$, $p = 0.12$), was not supported. Finally, H7, which suggested a greater effect for professional citizens compared to ordinary citizens, was not supported ($\beta = 0.02$, $p = 0.59$).

Results of control variables

The control variables – including types of e-government resources (social norm vs. technology: $\beta = -0.002$, $p = 0.97$; service vs. technology: $\beta = -0.03$, $p = 0.39$), types of e-participation (agenda setting vs. monitoring: $\beta = -0.05$, $p = 0.34$; decision-making vs. monitoring: $\beta = 0.06$, $p = 0.14$), study design ($\beta = 0.04$, $p = 0.60$), and year of publication ($\beta = 0.002$, $p = 0.94$) – all exhibited non-significant effects.

Robustness Analysis

Based on the sample-adjusted meta-analytic deviancy method (Beal, Corey, & Dunlap, 2002), we identified six clear outliers and four potential outliers. To assess their impact, we compared the

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moderating effects using both the complete dataset and the reduced dataset excluding these outliers (Geyskens, Krishnan, Steenkamp, & Cunha, 2008). The results indicate that outliers do not significantly affect our findings, as analyses using the reduced dataset produced consistent results with the complete dataset (see Table A3 in the Appendix).

Discussion

This study primarily conducts a meta-analysis to examine the moderating effects across 517 relationships reported in 126 publications on e-participation intention. The findings indicate that e-government resources have a greater impact on e-participation intention when delivered through social (vs. official) channels, applied to specific (vs. general) government affairs, implemented at the regional (vs. national) level, and situated in developing (vs. developed) countries.

Theoretical Implications

This study offers several theoretical implications. First, it systematically develops a conceptual integration of when e-government resources influence e-participation intention from the perspective of citizen experience. This study addresses Kim and Lee's (2012: 820) observation that 'the literature has left significant gaps in our understanding of the relationships among the management of e-participation applications, citizens' experiences of e-participation, and e-participants' trust in government'. Through a meta-analysis, we identify four primary contingency factors that shape the relationship between e-government resources and e-participation intention. Building on these factors, the findings confirm that e-government resources delivered via social channels, targeted at specific government affairs, implemented at the regional level, and situated in developing countries can serve as an effective strategy.

Second, from the perspective of the experience channel, the stronger effect of social channels compared to official e-government platforms aligns with technology affordance theory (Anderson & Robey, 2017). This suggests that informal, interactive platforms facilitate engagement more effectively due to their perceived accessibility and two-way communication features. These findings support prior research (Medaglia & Zheng, 2017), which argues that citizens prefer platforms that allow direct interaction with peers and officials rather than passive information portals.

Third, from the perspective of experience affairs, the finding that e-government resources exert a stronger influence on specific government issues than on general governance matters (e.g., national budgets) extends issue-public theory (Converse, 2006) to e-participation. Citizens are more likely to engage when issues directly affect their interests, consistent with selective exposure theories (Chernov, 2022). This suggests that e-government systems should prioritize issue-based segmentation to enhance participation. Furthermore, the stronger effect observed for regional (local) government affairs compared to national affairs supports proximity theory (Denters, Goldsmith, Ladner, Mouritzen, & Rose, 2014), which posits that citizens engage more when they perceive a direct impact on their daily lives. These findings challenge the assumption that national digital governance uniformly boosts participation, highlighting that decentralized e-government strategies may be more effective.

Fourth, the type of e-government resources did not have a statistically significant effect on e-participation intention. Although resource provision remains a central construct in digital governance frameworks, its direct predictive power may be attenuated or mediated by contextual factors such as developmental stage, institutional capacity, or prevailing civic norms (e.g., Linders, 2012). This non-significant effect challenges the assumption that material or technical resources alone can stimulate engagement and instead highlights the importance of structural and environmental enablers of participatory behavior.

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Finally, this study contributes to academic discourse by providing a comprehensive meta-analytic perspective on e-participation intention. By synthesizing findings from a wide range of studies, it offers a more robust understanding of the conditions under which e-government resources foster public engagement, thereby paving the way for future research in this domain (Alarabiat, Sá Soares, & Estevez, 2021).

Practical Implications

First, our empirical findings help governments determine whether enhancing citizens' e-participation intention is a viable strategy. The results suggest that governments should focus on strengthening e-government resources through social channels, for specific government affairs, and for regional (rather than only national) government matters. Such targeted efforts are especially effective in increasing e-participation intention among citizens in developing countries. Understanding the specific needs and preferences of different citizen groups can further guide the design of tailored support initiatives.

Second, this research underscores the importance of tailoring e-government strategies to regional rather than solely national contexts. Policymakers should consider the varying effectiveness of e-government resources across administrative levels and cultural settings, enabling more targeted and impactful digital governance initiatives (Tejedo-Romero, Araujo, Tejada, & Ramírez, 2022).

Limitations and Future Research

While this study operationalizes 'experience stage' using the Human Development Index (HDI) as a proxy, it is important to acknowledge that HDI may not fully capture the multifaceted nature of digital readiness. For instance, Alharbi, Kang, and Hawryszkiewycz (2015) found that factors such as trust and subjective norms significantly influence citizens' intention to engage in e-participation through e-government websites. These psychological and social factors may vary across different stages of digital maturity, suggesting that alternative or composite measures – such as digital readiness indices or ICT adoption statistics – could provide a more nuanced understanding of the experience stage.

Second, this study controlled for several moderators; however, it is not feasible to incorporate all potential confounding or contextual variables. Beyond factors such as experience channel, experience affair, experience environment, and the characteristic of experiencer, other variables – such as sample characteristics (e.g., age, gender composition, sector), and whether the experience was online or offline – may systematically influence the observed effects. Since these moderators were not consistently reported across studies, they could not be incorporated, which limits the comprehensiveness of the findings.

Finally, this meta-analysis is restricted to English-language publications, which may introduce language bias and limit the generalizability of the findings. Future research should broaden the literature search to include non-English journals and regional databases, employ multilingual search terms and translation support, and, where possible, involve native-language collaborators to capture a more comprehensive and globally representative set of studies.

Data availability statement. All data, materials, and statistical code used in this study have been deposited in the Open Science Framework (OSF) and are publicly available at https://osf.io/9yu7z/?view_only=713587f95ccd48a8a8071dceaaee0a5b

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Notes

1. We thank an anonymous review team member for suggesting this point.
2. Experience stage was operationalized using the Human Development Index (HDI), a widely recognized indicator that captures essential dimensions of societal development – education, income, and health. These dimensions are closely related to individuals' access to, and familiarity with, digital government services. However, in some cases, World Bank income classifications were not available for specific years or countries; therefore, HDI was used for better data continuity and coverage.

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Appendix

Table A1. Selecting and coding criteria for the variables in the meta-analysis

Original constructs	Definition	Selecting criteria	Examples/representative references	Intercoder reliability
Independent variable				
E-government resources	The supportive resources provided by governments to enhance citizen e-participation.	Educational institutions; basic telephone service; mobile services; narrowband Internet service; DSL-based Internet service; remote electronic voting systems; on-line tax system; e-tax filing and payment system; NGOs; political institutions; government ministries; civil society organizations; e-government learning services; e-mail lists; electronic participative budget; e-government tools; online voting; online consultations platforms	Bwalya, Du Plessis, & Rensleigh (2012), Bataineh & Abu-Shanab (2016), Chugunov, Kabanov, & Zenchenkova (2016)	100%
Dependent variable				
E-participation intention	The willingness of citizens to use information and communication technologies (ICT) to engage in a government's policy, decision-making, service design, and delivery.	Intention; Continuance Usage Intention; Intention to Use Russian Public Initiative Voting; Intention to Use E-government; Continuance Intention for E-participation; E-government Use Intention; Intention to Use the Portal; Behavior Intention; Continuance (Continued) Intention; E-participation Usage; Mobile App Future Use; E-tax Filling Adoption Intention; Intention to Participate in E-government (Revisit)	Almahamid & McAdams (2010), Ziba & Kang (2019), Zheng & Ma (2022)	100%
Original constructs	**Definition**	**Coding/measurement**	**Examples/representative references**	**Intercoder reliability**
Moderators variables				
Experience channel	The channels for civils to participate in e-government online.	**Social Channel**: social robots; Social websites; Facebook; social media **Official Channel**: Government websites; Government system; E-tax system; Government Web 2.0	E-government state financial application system Facebook (Alarabiat, Sá Soares, & Estevez, 2021)	100%

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Table A1. (*Continued.*)

Original constructs	Definition	Coding/measurement	Examples/representative references	Intercoder reliability
Experience stage	The country of e-participation.	We used Human Development Index (HDI) to measure experience stage based on *the Human Development Report 2021/2022.* If the value of HDI is more than .9, the countries are developed countries; otherwise, the countries are developing countries.[2]	Malawi (Ziba & Kang, 2019), USA (Carter & Belanger, 2004)	100%
Experience level	The geographic scope of e-government affairs based on where it takes place.	We differentiate e-participation depending on the range of areas of public affairs. **Regional affairs**: Local or municipal-level public affairs, involving governance issues limited to cities, provinces, or sub-national regions. **National affairs**: National or cross-regional public affairs, involving governance at the country level or spanning multiple administrative units.	Electronic tax-filing systems in Taiwan province, China (Wang, 2003), government affairs in the context of urban China (Zheng & Ma, 2022) E-government affairs implementation in Zambia (Bwalya, Du, Plessis, & Rensleigh, 2012), e-government services in the Netherlands (Horst, Kuttschreuter, & Gutteling, 2007) and so on.	100%
Experiencer characteristics	Citizens with varying degrees of professional knowledge in e-participation.	**Professional citizens**: citizen who has knowledge about e-participation (e.g., government employees, civil servants, policymakers, or experts). **Ordinary citizens**: citizens who do not have knowledge about e- participation (e.g., residents, voters, or non-professional users of government services).	Seoul citizens by a university located in Seoul (Choi & Song, 2020) all Jordanian citizens who have already used e-government services (Almahamid & McAdams, 2010)	100%
Experience field	The nature of civil participation in e-government affairs based on the whether it is a specific transaction.	We differentiate e-participation depending on the range of public affairs. **Specific affairs**: E-participation that focuses on a clearly defined issue or policy domain (e.g., urban planning, environmental regulation, education reform). It typically involves targeted input on particular projects or decisions through issue-based platforms or consultations. **General affairs:** E-participation that covers a broad range of public affairs without focusing on a single topic (e.g., routine service delivery, general citizen feedback, or everyday issue reporting). It often occurs through open platforms designed for continuous interaction with government.	Health care (Varda, Shoup, & Miller, 2012), education (Kettl, 2001) or e-taxing (Chen & Huang, 2009), Project proposals (Naranjo-Zolotov, Oliveira, & Casteleyn, 2018) and so on.	100%

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Table A1. (*Continued.*)

Original constructs	Definition	Coding/measurement	Examples/representative references	Intercoder reliability
Experience culture	Cultural values and social perceptions of the area in which civils live.	We classify countries based on their score on the Individualism Index (IDV). Countries with IDV scores less than or equal to 48 are categorized as collectivist cultures (coded as 0), while those with scores greater than 48 are categorized as individualist cultures (coded as 1). This cutoff is based on data from Hofstede Insights, where the median IDV score across approximately 70 countries is 48.	Jordan (Almahamid & McAdams, 2010), Netherlands (Van Dijk, Peters, & Ebbers, 2008)	100%
Experience system	The nature of government political system.	Following Manikkalingam (2000), we classify countries based on their constitutional structure into either federal or unitary systems. Countries with a federal constitution, in which sovereignty is constitutionally divided between a central government and subnational units (e.g., states or provinces), are coded as federal systems (1). Countries with a unitary system, where power is centralized and any subnational authority is delegated by the central government, are coded as unitary systems (0).	China (Chen & Zhang, 2012), Greece (Panagiotopoulos, 2012)	100%
Control variables				
Types of e-government resources	The types of e-government resources, which includes technology, social norm and service.	**Technology**: electronic participative budget, e-government tools, online voting online consultations platforms, remote electronic voting systems, on-line tax system, e-tax filing and payment system, and so on **Social norm**: opinions held by media, friends, family, colleagues, neighbors, educational institutions, NGOs, political institutions, government ministries, civil society organizations and so on **Service**: e-government learning services, e-mail lists, basic telephone service; mobile services; narrowband Internet service; DSL-based Internet service and so on	e-government learning services (Al-Omairi, Al-Samarraie, Alzahrani, & Alalwan, 2021) wireless internet parks (Weerakkody, 2008), my family's opinions (Choi & Song, 2020)	98%

(*Continued*)

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Table A1. (*Continued.*)

Original constructs	Definition	Coding/measurement	Examples/representative references	Intercoder reliability
Types of e-participation	The types of e-participation.	**Monitoring**: E-information, E-deliberation, E-complaints and so on **Agenda Setting**: E-petitions, E-initiatives, E-campaigning and so on **Decision-making**: E-consultations, E-participatory budgeting, E-voting and so on	e-government learning services(Al-Omairi et al., 2021), e-information (Chen & Zhang, 2012), e-consulting (Bataineh & Abu-Shanab, 2016)	99%
Subjective vs. objective	The types of study data.	We code objective as 0; subjective as 1. We consider the questionnaire data as subjective data and database data or crawler data as objective data.	Data from the Russian Statistics Service, the Ministry of Communication of the Russian Federation (Chugunov, Kabanov, & Zenchenkova, 2016), Questionnaires (Hossain, Adnan, Rahman, & Muhammad, 2023)	100%

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Table A2. A partial sample of experiments in meta-analysis

Author name (year)	Context	ECnl	EF	EL	EStg	EClt	ESys	ECrt	SS
Almahamid and McAdams (2010)	E-participation in Jordanian and data collected from all Jordanian citizens who have already used e-government services	Official channel	General government affair	National government affairs	Developing country	Collectivist culture	Unitary system	Professional citizens	400
Alharbi & Sandhu (2018)	E-participation in Saudi and data collected from students using web-based questionnaire	Official channel	Specific government affair	National government affairs	Developing country	Collectivist culture	Unitary system	Ordinary citizens	472
Dimitrova & Chen (2006)	E-participation in United States and data collected from citizens	Official channel	General government affairs	National government affairs	Developed country	Individualist culture	Federal system	Ordinary citizens	447
Horst, Kuttschreuter, & Gutteling (2007)	E-participation in several cities in the Netherlands and data collected from citizens	Official channel	General government affair	Regional government affairs	Developed country	Individualist culture	Federal system	Ordinary citizens	144
Hu, Chen, Hu, Larson, & Butierez (2011)	E-participation in United States and data collected from 40 field officers	Social channel	Specific government affairs	National government affairs	Developed country	Individualist culture	Federal system	Professional citizens	41

Notes: ECnl, Experience Channel; EF, Experience Field; EL, Experience Level; EStg, Experience Stage; EClt, Experience Culture; ESys, Experience System; ECrt, Experiencer Characteristic; SS, Sample size.

Table A3. The results of robustness analysis

	Robustness analysis: Outlier bias	
	Model without four outliers	Model without ten outliers
	Coefficient (SE)	Coefficient (SE)
Constant	0.47 (6.09)	−0.50 (6.05)***
Moderator Variable		
Experience Channel: Social (vs. Official) Channels	0.06 (0.04)*	0.06 (0.04)*
Experience Field: Specific (vs. General) Government Affairs	0.08 (0.04)**	0.06 (0.04)*
Experience Level: Regional (vs. National) Government Affairs	0.09 (0.04)**	0.08 (0.04)**
Experience Stage: Developed (vs. Developing) Countries	0.11 (0.05)**	0.11 (0.04)**
Experience Culture: Collectivist (vs. Individualist) Cultures	0.09 (0.06)	0.09 (0.06)
Experience System: Unitary (vs. Federal) System	0.06 (0.04)	0.06 (0.04)
Experiencer Characteristics: Professional (vs. Ordinary) Citizens	0.02 (0.04)	0.01 (0.04)
Control Variable		
Type of E-government Resources: Social Norm vs. Technology	−0.002 (0.04)	−0.003 (0.04)
Type of E-government Resources: Service vs. Technology	−0.03 (0.03)	−0.03 (0.03)
Type of E-participation: Agenda Setting vs. Monitoring	−0.05 (0.05)	−0.03 (0.05)
Type of E-participation: Decision-making vs. Monitoring	−0.06 (0.04)	−0.05 (0.04)
Type of Study Design: Objective (vs. Subjective) Data	0.04 (0.08)	0.05 (0.08)
Year of Publication	0.000 (0.003)	0.004 (0.00)
Number of Effects	125	123

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. We employed random model to analysis moderating effect.

Lifang Peng (lfpeng@xmu.edu.cn) is a full professor in the School of Management at Xiamen University, China. Her research interests are in the areas of e-commerce, e-government, and modern services. Her work has appeared in *Journal of Electronic Commerce Research, Information & Management, Computers in Human Behavior, Electronic Commerce Research and Applications, Electron Markets*, and other journals.

Suli Wang (wangsuli97@163.com) is a PhD student in the School of Management, Xiamen University and Management, China. Her major research areas include consumer behavior and e-government. Her research has been published in *Telematics and Informatics, Journal of Information Science*, and others.

Hui Jiang (fidojianghui@hotmail.com) is an assistant professor in the Department of Marketing, School of Economics and Management, Tongji University, China. His major research areas include consumer behavior, creativity management, and new product adoption. His research has been published in *Journal of Marketing Research, Journal of Creative Behavior, Creativity and Innovation Management, Computers in Human Behavior*, and others.

Kaichao Wang (w1285077616@163.com) is a PhD student in the Department of Information Management and Decision-Making Science, School of Business and Management, Shanghai International Studies University, China. His major research areas include consumer behavior, creativity management, and new product adoption. His research has been published in *Telematics and Informatics, Journal of Relationship Marketing*, and others.

Gang Li (lig@sdas.org) is a professor in the Shandong Computer Science Center, Qilu University of Technology, China.

Yubo Peng (pengyubo2007@126.com) is a doctoral student at the School of Economics and Finance of Xi'an Jiaotong University, China. His major research areas include trade investment, digital economy, and electronic commerce. His research has been published in *Psychological Science, Intelligent Internet of Things Computing, Security and Networks*, and others.

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